THE NEON NEWS

NEON LITE

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Art's swell that ends well: Teaching artists about neon

An interview with Maureen Havey

*<**Editors' note:** Maureen Havey of Studio One Neon in Santa Fe sent us some material about an art show she was in, and this made us curious about both her unusual background and the topic of how neon people can work with non-neon-bending "neon artists."*

The following sketch of her background comes from a newspaper story by Candelora Versace: "Working as a medical illustrator in the mid-80s, she often took art classes on the side, never considering a career in fine art. In 1985, she found a neon class at the Art Institute of Chicago and was hooked.

" 'But it was one of the most horrendous things I've ever had to learn and I wouldn't recommend it to anybody,' Havey said with a laugh. 'It's very labor-intensive... I'm lucky because I have one local artist who does production work of his sculptures that pretty much keeps me employed... It's very rare to find an artist who does his or her own bending, and I prefer to work with artists...'

"Havey said the work of bending neon is highly technical and intimidating to artists as well as potentially dangerous. She continues to occasionally teach one-day workshops in neon, however, because 'It's good for artists to see what's involved. They usually hate the class and can't wait for it to finish, and they realize they're better off hiring me than trying to make their own.' "

*<**Val:** What do non-neon people need to know about neon, and what problems arise when they don't?>*

The dark side of the artist / bender relationship

Maureen: You're asking if they should have some formal knowledge about the medium before just trying to use it in their artwork? *<Yes.>* I totally agree... With the artist I do a lot of neon for, it's real cut-and-dried, and I make

(see Havey, page 10)

<What do you teach people in your one-day neon course?>

I start out in the morning with a brief telling of my involvement with neon, and then a short go-round on the personal interests of each student in the class, so the course is useful for them individually. Then I go through the history of gas-discharge tubes, and in the future I will discuss the earliest Geissler tubes... I really emphasize the efficiency of neon and the longevity of it, and that the reason that it kind of fell out of popularity had more to do with the politics of neon than with anything else.

I have found that the classes attract mostly artists, though I've had one geologist and one Los Alamos physicist, which bears out my own science and art background...

Then after I do the history I get into just the basics of neon: how it works, how to wire it, all about the different glass types. The biggest question is 'how does it get its color?' so I go through that, show them all the different types of tubes, show them as many different types of transformers as I have around, or brochures and stuff on the transformers, without being too worried about people buying them directly. You know, I do like to sell transformers and do a markup like everyone else, but what I find is that a lot of people have an interest in neon and very few people really follow up on it.

So I'm pretty free with the information, because I'd rather they just saw the availability of it *<neon>*. I just don't think many artists are doing much with it yet, and I think that they could be doing more, and more interesting things.

So that's basically what I do, a little lecture, and that brings us up to around lunchtime usually, after questions and answers. And in the afternoon there's hands-on, and I only have one ribbon fire and one cannon fire, so I

(see Artists' course, page 16)

Neon history -- a blast from the past

<Editors' note: We have grown accustomed to finding fat envelopes of treasure in our mailbox from neon history buff Mark Cherveny, who combines an exhaustive curiosity with a knack for research.>
By Mark Cherveny

On the subject of **manifold cleaning** I agree with Mr. Boonstra, I have always found it quicker to toss the old manifold away and make a new main section than to clean one (based on my experience cleaning old diffusion pumps). Making a new manifold also avoids the mercury hazard.

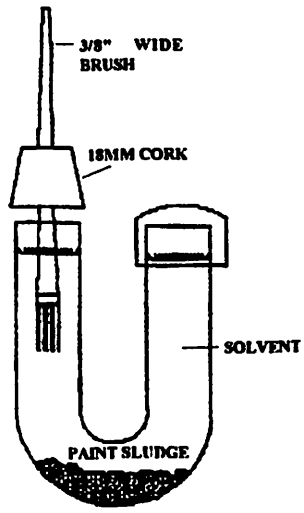
Dr. Argon's **wire-splicing cover** is very unsafe: it would never fly at a union shop. If you insist on this method, at least use a piece of 12 or 15 mm glass as the "splicing compartment" and cover the assembly with high-voltage rubber tape. Sure it will be ugly, but being sued for a fire is even uglier!

Dr. Argon's **manometer** has the bends. It bubbles for the same reason that pop bubbles when you release the pressure when you open it. All liquids dissolve gases to some degree; the colder the liquid and the higher the pressure, the more gas dissolves. A cold shop and leaving the manometer exposed to air pressure make the problem worse. I assume that he noticed that the manometer outgassed (bubbled) while being pumped down, and then again when he backfilled the tube. This second bubbling is caused when the manometer fluid moves; it brings fresh liquid up to the surface which hasn't given up its gas. I can assure you that it isn't influenced by the moon. The cure is to keep your manifold under vacuum.

If oil backs up from the *<turned off>* pump when you do this, you may be able to add on an old gas flask (tubulated at the top with 18mm glass, carefully preheating the top of the flask) to the vacuum pump inlet. This flask acts as a safety reservoir to catch any oil that may backflow from the mechanical pump. At the end of the day just close the main stopcock and turn the pump off, watch for any sucking back. If your vacuum pump always backs up you can also perform vacuum pump bypass surgery: seal a stopcock (a 2 or 4mm bore one will do) between the main stopcock and your vacuum pump to let your vacuum pump back to air.

As for Dr. Argon's problem with **"side discharge"** on electrodes, he should try a new box of EGL's 8cc electrodes: they have recently solved the problem with them side-discharging. However the 9cc (12mm ceramic) collar electrodes seem to be especially prone to this problem. This is caused I believe by the too small hole in the ceramic collar and the shell not being centered in the glass. As long as the discharge fires from both the outside and inside it will eventually fire only from the inside after burning in. If it only fires from the outside, then you can try to center the electrode shell using a very strong magnet. You hold the magnet above the luminous part of the electrode; it will take some experimenting and time to get a feel for it. See if the discharge moves when you apply the magnet and move it halfway between the two places where the discharge was, and move slightly forward. You will need to support the magnet in position if the side discharge returns after you remove it. If the side discharge persists I recommend replacing the electrodes on neon-gas tubes, being sure that the new electrodes are centered in the glass (if not, use a small file tang or similar object to straighten them). Rumor has it that EGL will come out with a new version of the 9cc electrode that won't be so prone to side discharge. Neon Products and most Masonlite electrodes don't have this problem, so switching electrode brands is the sure cure.

A useful addition to your **blockout cans** is a brush-holder. I find if you leave the brush in the can it just gets all gummed up; if kept in the holder it is always ready for use and you don't have to spend time cleaning your brushes. Another good idea is to spotweld or bolt a handle onto your blockout can lids: this prevents them from getting warped and is much easier to open.



Blockout brush holder (tape to side of can)

At NESA last year I heard that **O-ring connectors** leak very slowly, i.e., if you don't use up a gas flask in less than six months it will be contaminated by a slow leak. The problem is that the flask neck slowly is drawn in by the vacuum and air slips by the O-ring on the surface of the glass. If one puts a constriction on the tube with the O-ring connector to prevent the neck of the gas flask from sliding in, this should solve the problem.

An interesting tube: use white glass with ceramic-collar electrode and pump with a pinhead of mercury, fill with 3 torr neon and dump in the mercury. Burn in till uniform on a conventional transformer.

(see Mark, page 4)

Dear neon family,

We were planning an ambitious issue, and our ambitions tripped us up. We wanted to cover the perennial problems that irk neon people but boil down to educating non-neon people about neon -- what customers should know about quality neon; what artists, architects and designers need to know to avoid nightmare installations; and what suppliers need to know about shipping glass without breakage.

Then Val's long hospitalization and the death of our newborn daughter laid us low, and now this issue is awfully late. So you're getting what we have in hand, and we're asking your help to cover those ambitious topics next time.

And we're making official what has been de facto for a long time: The newsletter is not strictly "quarterly," but comes out when we have enough material and time to put it together. Subscriptions are for four issues, not one year. So if you get nervous and think you've missed an issue, call us or check with friends who also subscribe.

Finally, we will have to raise sub rates next issue, to cover the doubled postage costs and extra printing expenses from each issue being longer (it's been a long time since we held the line at the 12 pages we budgeted for). We hate price increases -- inflation never seems fair -- so if you renew your subs before the next issue (May 1 or earlier), you can pay the old price. (Otherwise, we're looking at four issues for $20, $22 in Canada and $25 abroad.)

Have fun and keep in touch -- Val + Ted

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Bent there, pumped that: Are we red yet?

More on uncoated ruby red glass:

<From our neon history expert, Mark Cherveny of Edmonton:>

On the hot topic of uncoated ruby tubing, I have an article from the August 1954 Signs of the Times, "Practical Pumping Procedure for Uncoated Ruby Tubing" by Charles Wilhelm of American Glass Engineering, Linbrook NY. Here are key points and quotes:

"I have had many requests for information on the methods of pumping ruby uncoated tubing successfully." (It appears Mr. Brown was right about there being just as much problem in pumping the original Corning ruby as we have today.)

"In my opinion, the only reason the powder was put in this glass was to make it easier to pump, but ... all coated tubing is easier to pump than the clear glass." (This statement seems to be true, as GE in the 1950s sold ruby glass coated blue. I assume that rose light filtered by the ruby would be a deeper shade of red.)

"<Heat the glass> until the newspaper gets a real dark brown, practically falling apart." (A good guess is 500 F or 265C.)

"If you have a good pump system, you will have the necessary vacuum of 0.1 micron before the tube is even cool enough to handle." (This supports Joseph Keller's idea of insulating the tubes to hold the heat in and prevent the contaminants from condensing back onto the glass.)

<Kent Fiske of Jackson WY is primarily a stained and blown glass artist, so he brings a different expertise to the ruby red ruckus:>

...[I]n cadmium-selenium ruby glass, cadmium sulphide volatilizes from the glass at working temperatures and can condense on the inside of the tubing during manufacture or bending (see W.A. Weyl's Coloured Glasses, page 274). Then if a slightly dirty tube is sealed off, oxygen in the plasma column will hit the cadmium sulfide (CdS) and produce sulfur dioxide (SO2). I believe SO2 produces a blue light and I doubt it would "clean up" as fast as air or water vapor.

Now, CdS is slightly soluble in ammonia, which would explain why an ammonia wash helps. My Handbook of Chemistry and Physics says CdS is even more soluble in acids but another reference mentions it only dissolves in strong concentrated acids. Did Henry Brown try washing tubes with acid? If acid doesn't help, then this idea goes down the tubes (sorry)...

But if CdS is the problem, it would explain why an extended warm bombardment and rinse help by getting residual O2, but overheating hurts by releasing more CdS.

This also points out that sealing electrodes directly to a clean ruby tube could hurt by releasing more CdS at the weld and recreating the contamination.

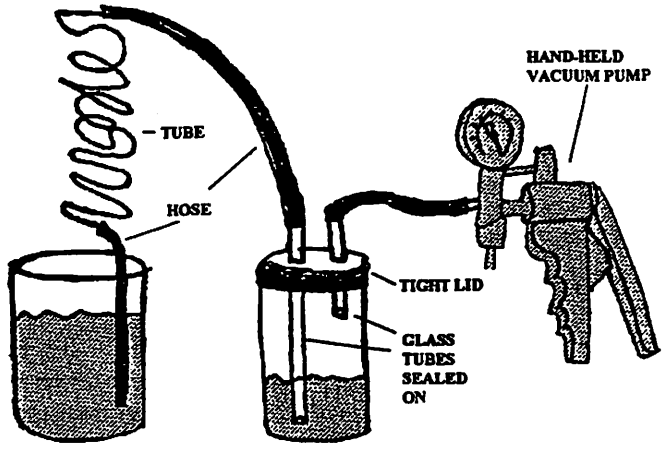
Possibly Corning has used a number of different ruby formulas over the years, or even made cased tubing where the color is just a thin layer over clear glass. Has anyone looked closely at the old tubing?

See if David Ablon thinks I'm chewing on my foot. Why did he think CO2 was the problem? Was it spectrographic evidence or just the color?

<He also mentions characteristics of different ruby red glasses he works with in stained glass: "If it is a cadmium-selenium ruby it will become opaque black with only mild heating, then return to ruby at room temperature. If it's a gold ruby, it'll retain its color up to bending temperature. Copper ruby will lose its color at bending temperatures and needs to be redeveloped (or "struck") at annealing temperature after bending.">

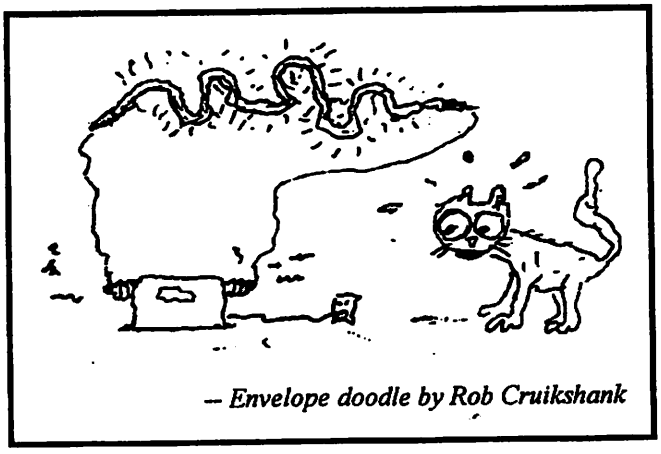
Ted here: I recently did an all-uncoated-ruby job (with the price jacked up accordingly), 15mm border tubes and 12mm script, all Tecnolux. The border tubes developed no problems being pumped fairly normally, but I decided to take no chances with the script and so pumped them inside fiberglass insulation, a la Joseph Keller's technique. Within minutes they were dimming out on the aging-in transformer, after an hour I had a slight tick of bright light by each electrode, completely dark everywhere else! 24 hours on the transformer helped them slightly, but only slightly. It was time to try the ammonia.

Now, I imagine it's easy to pour a liquid solution into a straight



tube and have it fill all the corners, but with bent tubes, forget it. If you try to pour in from the top, you soon have air pockets with increasing resistance until the flow stops. No amount of twisting and turning the tube will get the air out. So use a vacuum to suck in the liquid; it works great. Someday I may hook up an old beater vacuum pump with a stopcock just for this purpose (slick, huh) meanwhile I used a hand-held automotive-test-type vacuum pump (about $30, commonly available; mine is called "Mighty Vac"). It took a mere twenty or so times squeezing the lever to to fill each tube, using a tightly sealed jar to act as a trap and keep the ammonia out of the pump (see diagram). Henry Brown wasn't specific about how long to soak the tubes; I went for about 30 minutes.

Also, when I cut off the old electrodes, I kept about 3/4" of their clear glass to weld to, so I wouldn't be applying any more high heat to the ruby glass itself. I bombarded the tubes again to a minimal heat (a light tan on standard-weight paper) and there was no darkening on the aging-in transformer. The job has been up for four months now without any problems. ♦



– Envelope doodle by Rob Cruikshank

Sir Jerome... ...vs. the pattern monster

By Dr. Argon

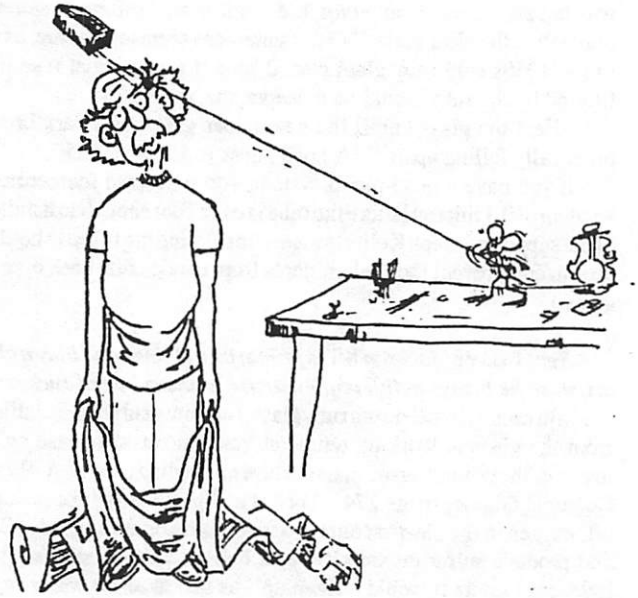
This is the tale of Jerry vs. the pattern monster. The monster was huge, 25 feet long and six feet tall. Its skeleton was composed of no less than 18 units, 161 feet including 'trodage. When angry, it would glow a clear red and flash "McCobb's."

Now Jerry (or rather Sir Jerome, Knight of Neon, DaDa Neon, master tube bender and Walter Cronkite lookalike) was a man up to the task of conquering this particular luminous gas and glass adversary. Sir Jerome has been bending glass for as long as this scribe has been alive, 45 years. He's seen them all come and stress-crack, and has observed the failures of his competitors.

But on this day a new obstacle was placed before him (actually, under him): a new set of raised floor boards...

I suspect it all happened when Sir Jerome tried to brand the pattern monster with a ribbon-burner-heated compound curve with double-back of 15mm lead glass. The monster reared up and wrapped its length around Sir Jerome. He fought gallantly, forcing the pattern monster prone on the bench, creasing it into smaller rectangles against the nonbestos. I thought he had won!

But the next moment the wizened gas master was down. In the monster's last-gasp offensive, Sir Jerome had jumped back for his knife to cut the menace down, and had become entrapped by the new flooring (raised platforms have a nasty way of tripping you up when tripping is most inappropriate). The crossfires lay broken and hissing on the floor – only a truly psychopathic pattern monster would throw Walter Cronkite into the heat of a 12-headed crossfire dragon! But even though wounded (14 stitches would be required to close his brow), Sir Jerome turned off the dragon's heat.



"How it really happened"; cartoons by Scott Mac Rae

I know there is supposed to be a moral at this point of the tale, so how about: Don't try mastering new flooring and jousting with a pattern monster at the same time.

Sure, why not. This is not literature, this is true life... ♦

(Mark, from page 2)

Now hit it with the tesla coil: what color is it? Try it with one of the single-lead-type transformers or use a Glow Tron base: what color is it now? and when you touch the glass?

Have you ever heard of "Zeon" tubing? It isn't a particular brand or company but the trade name for better-quality neon made by Neon Products and Electrical Products companies. I found out that after WWII these companies and others set up a laboratory and reviewed the results of the tests in the "Zeon" committee. This committee was made up of representatives of several companies and they published quality control memos giving a standard processing procedure and dictating the materials used in "Zeon" tubing. The testing lab and Zeon committee were run out of Electrical Products' head office in California (also known as the EPCO group). One interesting series of letters is on new phosphors (in the '50s). These letters revealed that the phosphor didn't live up to the manufacturer's long-term expectations and the Committee downplayed the difficulties in bending and processing the tubes. I am still working on digging up more stuff from this Zeon committee.

...O-ring connectors leak very slowly; i.e., if you don't use up a gas flask in six months, it will be contaminated by a slow leak...

As for Maureen Havey's question about **overfilling** method: This was investigated in the Zeon committee, and they developed a graded pressure chart for short tubes. It is imperative you fill with much higher pressure, for your 18-24" tubes, 12mm: 20mm; 15mm: 15mm gas pressure. See ST's Neon Techniques column in March '87 for a complete graded pressure chart. I have been using this on neon-gas tubes less than three feet long with good results. I have not found it necessary to increase filling pressures in mercury tubing if enough mercury is added; a dose about 4mm long in 5mm tubulation is usually more than enough. You may notice a slight color difference in rose (pink) neon tubes, but this is usually not detectable by the general public. Also I recommend ceramic collar electrodes as they sputter less and last longer. ♦

Commit an act of beauty: Try art glass

<Editors' note: Candice impressed us in Amsterdam with her great technique and broad knowledge of glass, casually making and giving away a delicate candy-striped Christmas tree ball and some multicolored beads. So we asked her to write columns on ornamental glass, and after moving back to the USA and enduring a car crash and more back problems, she is obliging us. This column mostly discusses materials, but if you buy them you will be ready for action when she offers step-by-steps in the next issue. Welcome home, Candice!>

By Candice King

I bet a lot of neon benders have wanted to make little goodies for Christmas or birthdays but have never seen it done, or don't know where to get the materials. I started out as an ornamental glassblower 16 years ago, and I'll do the best I can to explain the basics, but it's up to you to practice.

If you want to try ornamental glass, I strongly suggest you order a copy of Creative Glass Blowing, Scientific and Ornamental, (Hammesfahr & Stong, 1968, published by W.H. Freeman and Co., San Francisco) and have some basic supplies on hand. One of them, vermiculite, is available at greenhouses, where it is used to mix with potting soil for better drainage. I keep a cardboard box of it to bury my hot finished pieces in, as it doesn't stick to hot glass and keeps things hot a long time, thus reducing stress in the glass. (It's always better to anneal things in an oven, but we don't all have one available.)

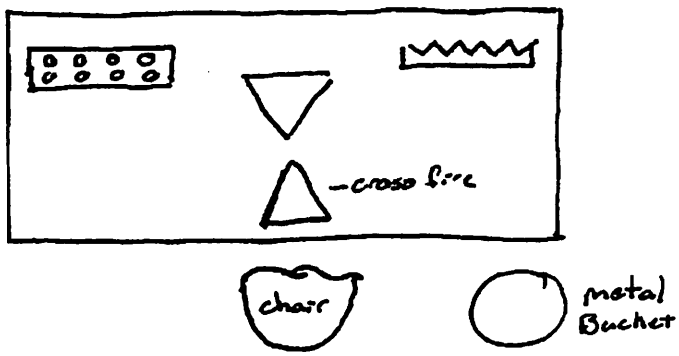
A 2x4 board 18-24" long cut with a sawtooth pattern makes a great place to rest hot glass rods or freshly pulled stems. This keeps hot glass from touching cold glass and keeps things from rolling off the table. You can get real fancy and nail a couple of blocks to the sides to help stabilize it, but you don't have to do that.

The next item to have around is a 2x10 board 12-18" long with holes drilled in it. This will hold hot pieces that need to cool before the next step. (You may already have this in your neon shop.)

Some ornamental glass can be made standing up at your fires just like neon, but it's much easier to keep your work turning true (which is critical) if you sit at a bench where your crossfire is mounted to the tabletop. I have a set of seven points mounted to a bench set up just for ornamental work. I like the seven-point better than a five-point because it's faster and I can make larger pieces.

Another handy thing to have is a rolling secretary's chair. It gives you lower-back support and makes it easier to turn away from the torch and blow into your pieces. Also, the height is adjustable and allows you to vary your position when you're at the torch for a long time.

I'm a right-handed glassblower, and this is how my bench is set up:



Lefties should reverse this for a more comfortable setup.

Carbon rods are another important tool. These are used to help form the hot glass; spinning out the foot of a vase, or making the hook on a Christmas ornament. These are available from your local welding supplier, as they usually are used for carbon-arc gouging of steel.

The rods are about a foot in length and vary in size from 5 to 10mm. Some of the smaller sizes have a copper sheath on them that is easily peeled away. Once you've gotten your carbon rods, use a grinding wheel to make a long, smooth taper to a point on one end. I suggest you have about six of each size. Carbon will not stick to hot glass unless the rod becomes very hot, so you may need to change rods several times when you're flaring out a large section of glass.

A metal trash can or bucket is a must. You need a place to put hot glass where it won't start a fire. Never put paper or plastic in your hot glass can.

Other things you may find handy are scissors for cutting hot glass, long needlenose pliers, Windex and paper towels, and black-painted cardboard or sheet metal to give you a dark background behind your fires. Don't forget the standard burn cream and band-aids, either.

Back to the bench set-up: Set your fires close to the forward edge of your bench. The distance from the edge of the table will depend on your height and the length of your arms. When I drill the holes for my down pipes in the tabletop, I make a slot three or four inches long to allow for adjustments. The torches' height from the tabletop also should be adjusted for your comfort.

The diagram shows a comfortable working position, so you can adjust your fires with this in mind. You should be able to plant your elbows on the table and hold a piece of glass overhanded with your left hand, and the glass should be naturally centered in and at the height of your fires.

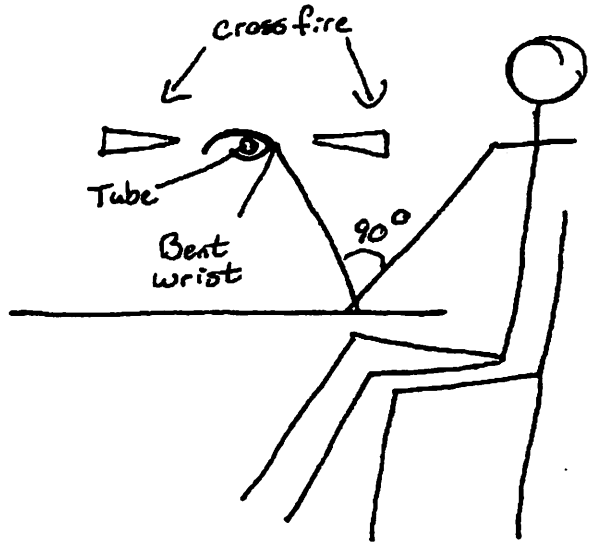
I make all of my gas and air connections underneath the table. Mount your gas and air valves and a main cutoff valve on the right front leg of your bench for easy access.

Now that you are set up, get ready for some practice time.

In the next issue I'll explain the basics of bead-making. Here is a list of materials you will need to have on hand:

– brass or steel rods approximately a foot long;
– kiln wash (of the type used for fused glass, not for ceramics kilns; check with your local stained-glass or furnace-glass suppliers);
– vermiculite;
– a long-necked ketchup or dressing bottle;
– soft glass rods 5-10mm in diameter. These are available through Houde Glass (800-526-1275), or beg a local furnace glassblower to pull some rods for you; I've also cut 1/4" strips of scrap stained glass and used that, but that's a bit awkward. ♦

(To be continued in next issue...)



Make your own high-frequency transformer

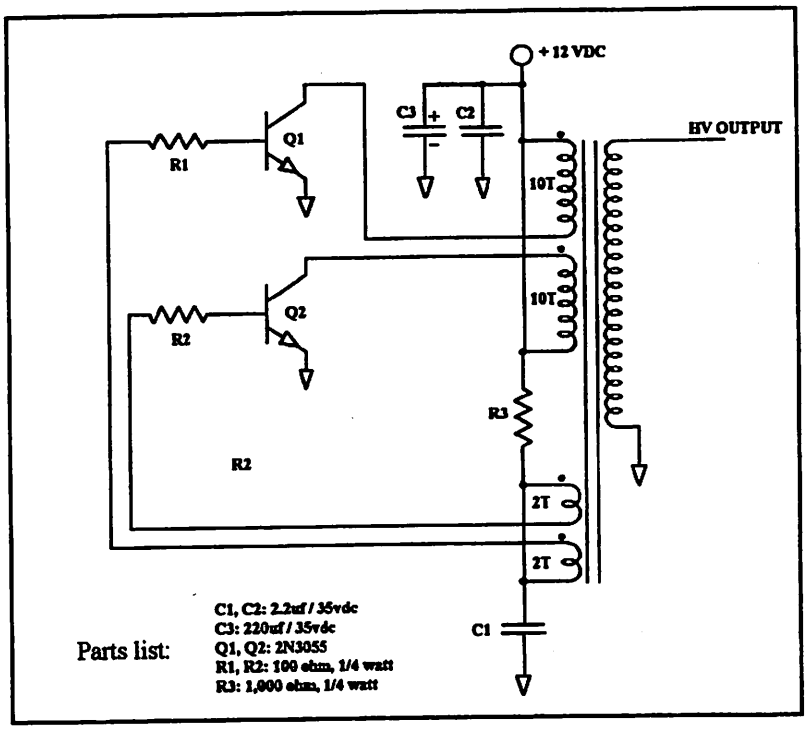
<Editors' note: Electrical engineer Telford Dorr, from "cut finger and blisters heaven" in Encinitas CA, last wrote about building a blower/air regulator in NN #9. He called recently about five articles he wanted to write, and here already are three of them: building your own solid-state power supply; using a $50 transformer for bombarding, and using a cheap arc welder as a choke. Stay tuned for "making your own neon dimmer from a $5 incandescent model" and "transformer control by computer".>

By Telford Dorr

Do you have a great idea for a single-ended tube project, but no access to a suitable high-frequency power source to drive it? Make it yourself! Here's how.

This circuit was designed to be as simple (read: cheap) as possible, using readily available components (Radio Shack, etc.), and to operate on 12 volts DC.

The centerpiece and one specialized component of the circuit is a surplus TV flyback transformer. Mine was like what is used in millions of Asian-made TVs. You can use virtually anything that has enough exposed core material to add windings onto, so don't be afraid to experiment.



Here's the deal: that cute little plastic block contains a high-voltage rectifier and possibly other parts (bleed-off resistor, capacitor, whatever). This is because the TV people want DC (direct current) applied to the picture tube. We want AC (alternating current) to drive our neon with. DC on a standard tube would require a connection at either end of the tube, and on mercury tubes would cause all the mercury to migrate to one (the negative) end. This is a common complaint with some early solid-state transformers; they cheated and used strange diode connection-schemes to boost the voltage. This technology was probably borrowed from laser power packs, but because lasers contain no mercury they can get away with it.

Look carefully at the wide side of the plastic block on your flyback transformer. (By the way, the term "flyback" relates to the way the transformer generates the high voltage in your TV. A high-voltage pulse occurs when the horizontal scanning beam in the picture tube "flies back" from the right side of the screen to the left. They're stealing a little of the stored energy in the deflection yoke, the coil gizmo around the neck of the picture tube that makes the beam scan the screen. It has nothing to do with insect anatomy -- just thought you might want to know.)

Now draw a line on the plastic from where the high-voltage wire comes out, parallel to the edge of the block. Use a Dremmel tool, with a small metal-end mill-type bit, and CAREFULLY start to dig a trench in the plastic, starting in the center of your line and moving about halfway to each end. Work slowly and be very careful.

If your luck holds, you will progress down through the epoxy fill material and reach a small cylindrical jobber with a wire lead coming from each end. One end will connect to the high-voltage wire coming out of the block, and the other end will eventually go to a winding on the transformer. DON'T try to find it. Before you realize it, you'll cut right through it, rendering your transformer junk.

What we really want to do is to solder a jump wire across the diode, in effect bypassing it. If you find any other components connected between the diode and high-voltage wire, cut through their leads (cut them back away from the diode as far as possible, so the high voltage won't arc to their cut-off ends.

(see Dorr, next page)

Modifying the flyback:

Because TV flyback transformers are designed to be used in circuits powered by 160 volts DC and greater, and because we want to power ours using 12 volts (much safer, and portable too), we must add our own drive windings. The two primary windings consist of 10 turns each of 22-gauge wire. I used plastic-covered low-voltage doorbell wire. The gauge isn't all that critical, but must be big enough to handle about 1 amp of current but still be small enough to wind in the available core area. The two secondaries consist of 2 turns each of 24-gauge wire. These windings handle less than 0.1 amp, and virtually any reasonable gauge of wire will work, as long as it is physically large enough to work with.

The windings are wound on in two groups, primary and secondary. The secondary group is wound on in a place as far away as possible from the primary group and the original flyback windings. This is to reduce any capacitive coupling between these added secondaries and the other windings; otherwise, weird instabilities may result. Wind all windings in the same direction around the core. Wind them on physically in the same order as shown in the schematic, which is to say we want the winding ends going to the transistors to come from the center of the winding pair, rather than the outside ends of the windings. This helps to reduce capacitance between primary and secondary windings.

There is one other modification which will probably need to be made to the flyback transformer, and you will want to do this before you add the extra windings. Take a look at the high-voltage wire coming out of the flyback. Does it terminate in some sort of spring-clip doohickey, probably with a rubber cup around it? This is the gizmo which connects to the TV picture tube. Does the other end come from a squarish plastic block, on the side of the flyback? No? Then skip this section; it doesn't apply to you. For everyone else, we're going to have to do a little surgery on Mr. Flyback to remove a few malignant parts.

(Dorr, from page 6)

Special note: some flybacks have a ceramic-bodied resistor buried in the epoxy block – don't hit it with your Dremmel tool bit. It's much harder than the steel in the tool, and will INSTANTLY cause the bit to turn cherry red, ruining the bit.

When you have completed the bypass surgery, fill in the remaining cavity with a little high-voltage putty (available at electronics stores catering to the TV trade.) When you're all done, you should be able to measure continuity with your ohmmeter from the high-voltage wire to one or more of the existing terminals on the flyback, or possibly to the frame of the transformer. Pick (only) one of these and connect it to your circuit ground point. After you finish getting everything working, you can try using one of the other terminals as a groundpoint. Experiment and see what works best.

Building the circuit:

If you can't find the specified transistors, don't panic. Virtually anything meeting the following specs will work:

- max. collector voltage (VCEO) – 60 volts or greater.
- max. collector current (IC) – 3 amps or greater.
- max. operating frequency (fT) – 100 khz or greater.
- min. gain (hFE) – 20 or greater.
- min. power dissipation (Pd) – 15 watts.

Both transistors should be the same part number. If you have PNP-type transistors lying around (2N3055s are NPNs), go ahead and use them. Just reverse the polarity of the applied power and any polarized capacitors in the circuit. It should work fine. Be sure to mount them using insulating mica and silicon grease on a suitable heat sink (I used a piece of sheet metal about 3 inches square).

Mount the flyback assembly and heat sink together. I wired my prototype "dead-bug-style" (all components on their backs, with leads sticking up in the air). Use whatever method works for you – the layout isn't all that critical. Although not shown on the schematic, adding a 3 amp fuse in series with the 12-volt power would probably be a good idea.

A quick note on power supplies: don't scrimp on your 12-volt power source. This circuit has been known to pull upwards of 1.5 amps with a long tube load. The little plug-in-the-wall power blocks commonly seen powering solid-state transformers may only be good for 0.5 amps, max! If your completed circuit seems a little anemic, make sure your power source isn't limiting its performance.

Testing the completed unit:

Here's a trick to avoid much agony and gnashing of teeth while testing your unit: for the initial test, connect a 12-volt light bulb (like an automotive turn-signal-size bulb) in series with your circuit. That way, if there are any catastrophic problems lurking, the transistors and your power supply won't go up in smoke and flames – the bulb will limit the maximum current.

Hook the high-voltage wire from the flyback to one end of a couple of feet of neon, and apply power. If you are greeted by that familiar red glow (from the neon, not the circuit), then great! Remove the light bulb, and you're done!

What, no glow? Drag! Along with rechecking your wiring, try swapping the two primary wires going to the transistor collectors. That should do it.

How it works (and why):

This circuit is a push-pull power oscillator. When you apply power, current through resistor R3 forward-biases both transistors. One of them will generally be slightly faster than the other. For sake of discussion, let's assume it is transistor Q1. It will start conducting current through its flyback primary winding, causing a magnetic field to build up within the flyback core. This changing field causes voltages to develop across all secondary windings. The secondary voltage causes base current to flow through resistor R1, causing Q1 to conduct even more, while the voltage from the other secondary reverse-biases Q2, causing it to turn off. As the flyback field saturates, the secondary voltages decrease to zero, and then reverse polarity. This causes Q1 to turn off and Q2 to conduct. The process repeats, back and forth, as long as power is applied.

I wired my prototype "dead-bug-style": all components on their backs, with leads sticking up in the air. Use whatever method works for you.

The high-voltage winding on the flyback has distributed capacitance associated with it, along with whatever is contributed by your connected neon load. This, along with the inductance of the high-voltage secondary winding, forms a resonant circuit, which determines the operating frequency. Mine runs at about 27 khz.

The number of turns in the primary windings tends to determine the resulting secondary high voltage – more primary turns, less high voltage, but more available tube current. You can experiment with the turn count to get the voltage you need (within reason). The secondary turn count should be adjusted to develop about -5 volts (peak) of reverse bias at the transistor bases (measure using an oscilloscope).

Note that any primary winding changes affect the secondary windings. Resistors R1 and R2 determine forward transistor drive current. All capacitors are bypass capacitors.

Note that the circuit has no protective components. That means if you hook the power up backwards, well...

Final thoughts:

While this circuit is not as efficient as it could be (a tradeoff for simplicity – feel free to improve it as you see fit), it will easily power 8 ft. or better of tubing (neon or argon/mercury).

By varying the supply voltage, you can get a tracing action in the tube, although this gets a little strange in tight lettering, where tube sections are close to each other.

But go ahead and experiment. Enjoy! ♦

In support of conductance

By Telford Dorr

Dick Boonstra's point on calculating conductivity of gas flow needs emphasis. If you plug in some numbers to this, some very interesting results appear.

His equation is for gas in molecular flow conditions (i.e., very low pressure/high vacuum, as found at the end of bombarding, when you're trying to get the very last of the yug out of the tube). What this equation is telling you is that, for every given pressure differential along a length of tubing, the flow rate varies as the cube of the diameter.

$$C = \frac{12 \times D^3}{L}$$

C = conductance
D = tube diameter
L = tube length

Let us assume we have several tubes of various diameters but of equal length, such that for a 5mm tube, the conductance is 1. We also assume constant wall thickness of 1.25 mm. Notice what happens as tube diameter increases:

(see Conductivity, page 16)

Take a flying leap abroad (but prepare for a rough landing)

<Editors' note: We hesitated to run this because so few American benders work abroad, but more opportunities seem to be coming up; we have heard of jobs for benders in New Zealand, Australia, Germany, Holland, France and Kuwait. Our friends who performed bending demos at Sign Europe said every day people would offer them work in various countries.

<If you want to live and work abroad, remember that it doesn't just happen, you have to look for it. Plan vacations around international sign expos. Or visit foreign shops and see what you would like to learn or do there; bring tools to use and neon toys to give to your hosts.

<And once you've found this kind of trouble and are about to leap, Candice -- late of the late Neon Workshop in Amsterdam -- has some advice for you:>

By Candice King

I'm happy to be back in the good ol' USA after a confusing and frustrating year of working abroad. Hooray for the land of 24-hour stores, carpet, warmth, sunshine, drive-in everythings, cars, good meat, and jumbo-size packages. Great radio, choice of goods... YEAH! When we had company from the USA a few weeks before we left, they left a dollar bill behind. We had it in the bookcase and prayed to it each time we passed by: "Oh please forgive me, I'll never abandon you again!"

I had had dreams of working abroad with my neon skills for years, and when the opportunity came to go, I jumped for it. I did lots of research before I left, but nothing could have completely prepared me for what happened. It's easy to get all starry-eyed with the romance of traveling, and discount or overlook potential problems. Here's a list of suggestions to help you avoid the pitfalls I encountered.

Keep in mind that what you expected before you went may never materialize. If things aren't going well and you think you smell a rat, you probably do. Follow your instincts and have a fallback plan.

I had a resume professionally prepared and faxed it to the potential employer overseas, and once I got the word that I was hired, I went to work on research. I was able to meet the bosses at NESA and spent some time with them. Meeting a future employer face-to-face is important, because you can get an idea of their style and can avoid some potential personality conflicts. It's expensive, but I would recommend you visit the country and see the shop in action if you can before accepting the job and packing up everything back home for a year or more (I didn't do this). Listen to the employers very carefully, and be very leery if the management doesn't want you to talk freely with the other glass workers. Sometimes what ISN'T said is most important, and employees may be afraid to speak their minds.

For research, these are some things you need to know and/or have in order BEFORE you leave home:

– visas;

– health care;

– housing;

– shipping and transportation costs (don't leave home without a round-trip open-ended ticket);

– customs regulations (will either country hassle you about your tools, household goods, bicycles, etc.?);

– background of the company (do they pay their bills? how long have they done business?);

– a clear explanation IN WRITING of your tasks and what is expected of you;

– a clear contract with all points included: don't let this be put off until you arrive; have this looked over by a lawyer or knowledgeable native of your new country;

– labor laws in the foreign country (and if anything in your contract conflicts with these, investigate carefully: i.e., overtime pay, employer-paid benefits versus withholding, etc.);

– your potential tax liabilities (as percentage of your new wage) in the USA and abroad, and an idea of the comparative cost of living (little things like each load of laundry costing $5 at the laundromat can catch you for big money over time);

– fully-arranged work permits for yourself, and your spouse if possible;

– finally, try to have enough money squirreled away somewhere to get home if things turn sour or a crisis strikes.

Does this sound like too much? Believe me, you can get rudely surprised on any of these counts unless you are prepared. And it isn't that hard to do this research using U.S. libraries and the embassy of the country you're going to.

Libraries should have language tapes (very helpful even if you're going to speak English in the shop) and books on history, local customs, and culture. The embassy should have information on the official policies and red tape, such as visas, work permits, cost of living, housing prospects, health care system, customs regulations and taxes. Embassies may also have a booklist and may even sell or send you books you can't buy here about the country.

There may also be a group of expats from your intended destination in your US city – I contacted the local "Dutch club" and went to several meetings to learn more about what the people are like (and what it feels like not to understand a single word anyone says).

When you get there, be prepared for culture shock, even in a country where English is spoken. This feeling of being overwhelmed, overtired and irritated by your new home tends to set in around the three-month mark. You're so busy getting settled in the first few months that you don't really have time to be homesick. But after a while the differences in culture and language get to you, and you feel like an outsider everywhere you go. It dawns on you that you're not on vacation and won't be going home for a long time. You miss your social network and familiar places and routines.

It does take time to establish new friends, so be prepared for a few quiet, awkward, even lonely months. I strongly suggest you try to find activities and friends that are separate from your work and co-workers. It isn't as easy as going out with your shop colleagues, but if you only hang out with them your world isn't much bigger than your workplace, and you can fall into the trap of not being able to separate relaxation from shop politics and complaints.

You may have the noble intention of immersing yourself totally in your new home (if you're single, you can seek a local sweetie!) but when you get tired of "adjusting" it's nice to have a bit of home to fall back on. If you take a little time to chase down other people from your country, and go see an occasional movie from home, your long-term mental health will probably be better. The American embassy (or Canadian or wherever your home is) will probably have a list of clubs and activities you can get involved with. These are great for

(see Work abroad, page 9)

Listen, Glasshoppa: Respect the master...

By Candice King

...Part of Nancy's article really struck me: the section about trade secrets <*NN#13/14*>. When I was a young bender I also thought every old-timer had a conspiracy going against anyone new. But now that I have some experience, I look at it much differently.

It's not that I want to keep all my little tricks to myself. I just want to know something about who I'm giving my pearls to. With the younger crop of neonites, many are working piecework and quantity is king, not quality. I've seen so much more shit glass in the last five to ten years that I don't want to help another hacker make money and destroy the craft with shoddy work.

The attitude of the new bender is what determines how helpful I am. I don't want anyone to kiss my butt and beg. I just want enough time to see if the passion is for money or craftsmanship. From my point of view there are a lot of benders fresh out of school who will work cheap, real cheap. And it drives the wages for an experienced bender down.

This is not the fault of the new bender but the general loss of pride and quality in the whole industry (the country, for that matter). Shame on the shop owner who doesn't care about the quality of the product. A lot of owners just want it made cheap: slap it up, collect the money, don't worry about service problems later, who cares if it burns out in six months, they've been paid.

I've seen a lot of shops that have more than three or four benders in a really fast-paced wholesale shop where everyone is paid piecework. Not one person had more than two or three years of experience. The prime motivator is $25-$75 per hour, depending on the project. Quality goes out the window, hands are overworked, and many times it's a dangerous work area.

I can't see myself contributing to this debauchery. Personally I would love to see a strong apprenticeship system re-emerge. This way a new bender is brought along under the care of someone experienced, and ends up an asset to the trade, and has a good support system. I feel sorry for many of the six-week wonders who have been cheated and deluded into thinking they know all they need to know.

Neon is like karate. It's the students in the lower belts who think they can kick butt and are cocky. But it's the old master black belt who never fights at all and has the self-discipline and wisdom to refrain from foolishness.

When the student is ready, the teacher will appear. Be patient, practice, and approach the old masters with respect. When you're ready, you'll learn. ♦

(Work abroad, from page 8)

comparing notes on any confusing aspects of your new country which the natives may be blissfully unaware of (like work permits, sending money back home, good travel agents and sympathetic English-speaking medical help).

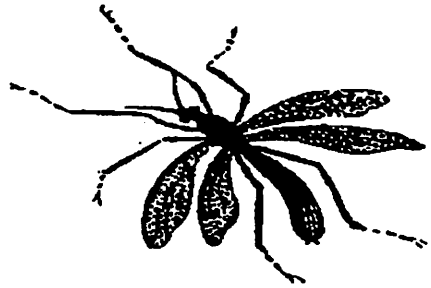
Embassies usually suggest you register your new address with them in case of emergency, and if you register properly you can also vote in elections back home, get free US tax information from travelling IRS agents. In most countries these embassies will maintain some kind of English library and/or cultural center for movies and performances. Remember too that you can get away to nearby countries for vacations – try to pick places that are different from where you are working, rather than facing the same old frustrations on vacation.

Coming home can be stressful too, but that's when you really notice the "good parts," like how nice it will be to go back to visit someday...

Keep in mind that what you expected before you went, or even on arriving at your new job, may never materialize. If things aren't going well and you think you smell a rat, you probably do. Don't hesitate to cut your losses and come home. It is horribly stressful to have your job and finances collapse in a foreign country (particularly if you haven't done all the visa/work permit paperwork right and the officials can't or won't help you). Follow your instincts and have a fallback plan.

Finally, remember that coming home can be stressful too, as you are saying goodbye to the friends and new situation you've slowly established for yourself. That's when you really notice the "good parts" – how nice it was to live without fear of violence, how much you liked certain things, how nice it will be to go back to visit someday without the headaches of working there!

For myself, the year abroad was one of extremes, both good and bad. There are few greater adventures than living in a foreign culture; it becomes part of you forever. (And it doesn't hurt in terms of long-term employment prospects either.) Just don't go into it with your eyes closed, and remember to have a good time. ♦



Dancing bug lights dull days

Bombarding tubes has gotten a lot more entertaining around here lately with dead bugs doing the jig. I use 30,000 volts at the start of each cycle and the static build-up around the tubes can get some serious motion going with lightweight critters. The most common dancers are shaped like large mosquitos but with long, skinny legs. The light draws them in, they die, they dance.

Recently one outdid the others by laying upside-down, legs in the air, and sliding twelve inches down the length of an eight-foot tube. Then it spun around and went back the other way, stopped, jumped a bit, changed direction. It did this again and again, reappearing with each new pair of tubes to pump. Finally it crumbled into pieces that scattered.

Later, three dismembered legs stood up in a row, dancing and twitching a bit. Each time I'd cut the power to open the stopcock or adjust the choke, they'd drop back down like exhausted athletes, arising again with the next hit of power. Finally the legless body reappeared, and they all did a jig together, the legs dancing while the body slid along one way and the other.

I was sorry to finish the job and end the show.

– Ted Pirsig

(Havey, from page 1)

sure it's that way, because we measure to the centimeter how big the tube is going to be, and then if it's off, it's my problem and I do it over. But it's important to GET THE PATTERN RIGHT in the first place so that I know what it is that he wants. Because any confusion over what the artist wants can be a potential problem causing unhappiness with the end product. They're thinking one thing, and they're not expressing it clearly to the neon person. This is especially true concerning color, and I go to great lengths to emphasize the fact that it's hard to know the effect the color's going to have until they use it. I've actually lent out small tubes and transformers to artists to take home and look at in their studios to get a better idea of the effect. That really seems to help eliminate confusion, and I'd really rather have their repeat business...

<Do you think there are technical problems that arise that way (from confusion) too?> Yes. *<Like what?>*

I think a lot of times the technical problems have to do with the obvious: electricity. I've worked with many artists who use metal, and it's not a real problem as long as the neon is kept away from it at least a quarter-inch. Some of the new transformers have problems being too close to metal surfaces. But on the whole, a lot of the trouble can be avoided by using some sort of physical barrier: glue, rubber, plastic – something to separate and block that electrical current that wants to jump to conductive surfaces. Also with the wiring; a lot of artists find it convenient to wrap the cable around tight metal corners, not realizing how much they're stressing out the cable covering. It's not meant to take that kind of abuse. So I tell them to use some kind of flexible casing and relieve the strain, and a physical barrier or at least a quarter-inch of air space to avoid arcing later. There's not a great understanding of how electricity works, or how to work with it, in our culture, which is surprising when you consider how intimately we all live with electricity. And most people I work with think they can do the same thing with a neon cable that they do with a lamp that they buy at the store. (But) there's a lot more voltage running through the neon cable.

I suggested we keep the neon above the toddler level, but no one seemed to take me seriously...

<So how much should they need to know? Should they learn about neon, or should they check with someone before designing, or after the fact? What would be your ideal way of averting problems from this ignorance about the technical aspects of neon?>

I think that before they even design their piece completely, they should be getting together with the neon shop. That would alleviate a lot of potential disappointment. And then they need some knowledge about installation. What happens in my business, and why I was open to it when I was asked to do a (one-day artists') class, is that I ended up giving people a lot of education when I give them their neon, and I don't charge for that information. I am helping them with their tube design, the color choice, transformer choice, and sizing the transformer to fit, of course, and then I'm giving them the transformer and the neon and saying, "This is how you connect it, this is how you support the tube, this is a good glue to use, this is what you have to look out for," and you know, maybe spending fifteen minutes to half an hour with them – and I feel like I should be paid for that knowledge. So I've tried to figure out a way to work that kind of charge in, perhaps a nominal consultation charge would be appropriate, I don't know. But for anyone who is interested in using neon a lot, I think it would benefit them to have more education, and the one-day workshop seems to be one way to do it.

<How about writing down a troubleshooting list?>

I think that's a great idea. Because when you think about it, there's really no other art form that has the same risks... Even those artists using sound or video aren't dealing with high-voltage components. So people either take it pretty lightly – I've had an artist bring in an old transformer with stereo wire as the secondary leads – or else they're totally paranoid, and afraid to pick up a tube...

<Have any artists you know had bad experiences?>

Not except for breakage. But they're always upset when they break it. And I tell them that everyone breaks it. I had to break a LOT of neon before I learned to bend it right, then handle it right. And you can tell most of the time by looking at the wall thickness around the break whether it was made badly and broke from brittleness, or whether some force was applied.

I once was caught in a predicament that could have been avoided if the designer had listened to my warning about little kids and neon. I was asked to outline the inside of a glass-block window in a residence with a two-year-old. In the design phase, I suggested we keep the neon level above the toddler level, but no one seemed to take me seriously. I made the two tubes, and installed them as specified, only to be called back less than a year later to fix a tube. The housekeeper was the one who told me how the tube broke: "I caught him (the toddler) putting this in his mouth," she said, aghast, as she handed me the electrode. I could only imagine that it was on when the little guy grabbed it and pulled. And then about six months later I was called back again to fix the other tube, this one smacked by a rubber ball... hmmm... I told the owners I would fix it one last time, but if anything got broken again, I would not repair it until the child was grown. Luckily they never called back, and I learned a good lesson about not letting my own common sense concerning safety be overridden by design aesthetics.

<Is tube life or staining a problem? Do you ever see things in galleries that are just bad examples of neon technique?>

I have had trouble with short tube life, in 12mm short tubes. I won't guarantee any tubes shorter than one foot now, and I always overfill them. I think mercury staining can be a big problem, caused by either too much mercury in the tube, or mercury combining with moisture or dirt in the mercury trap or the tube itself. I think a lot of the neon art from the 'sixties that I have seen in galleries has exhibited some bad technique, like exposed wire connections and black cable and black transformers hanging on white walls.

<What would you tell artists to do to minimize those problems? Do you recommend that artists design so electrodes are not visible?>

Yeah, I usually try to hide my electrodes, because I don't want the electrical connection in reach, and because the connection is usually not too pretty. If I can't hide the electrodes within the piece, then I use glass or rubber caps and paint them to blend in. I do have a problem with artwork that leaves the connections bare or wrapped in electrical tape, in reach of the public. You know people touch things they shouldn't, to see if it's on...

<Oh yeah: "Is this live?">

I realize it's the way neon wiring was taught in the sign shops for ages, and many people are still doing it that way. And that's not a good practice; it's going to give neon a real bad name, and already there's a movement to ban indoor neon, based solely on the high voltage. But since other electronic stuff, like microwaves and home entertainment centers, are getting up into the higher voltages (1000V and up), it's not going to be so easy to ban neon outright. Still, I think it's critical not to add any fuel to the fire, as it were, and to use all the available means to protect the high-voltage connections, especially the cable-to-cable connections.

<Have you had any strange experiences with artists?>

Most of the stuff I do for other artists is pretty routine, because

(see Interview, page 17)

New toys, suppliers, and other shop surprises

Jed Schliessner of Oshkosh WI recommends **Invac Industrial Inc.**, Vacuum fluid division, 35 Howard Ave., Box 373, Churchville, NY 14428. Tel: 716-293-3330; 800-962-8099; fax: 716-293-3093. Inland does nothing but make vacuum pump oil, both for diffusion pumps and forepumps, with economical alternatives ("chemically identical") to Dow Corning silicone fluids, etc. They can also reprocess your old silicone diffusion pump oil, at about one-third the cost of new, if you've saved up a gallon or more of it. Excellent literature, detailing the whys and wherefores of different oils.

From Glenn Karich in Embarrass MN: "A classy new product caught my eye. It's **Neostix** extruded aluminum neon fixtures with lenses. They make several designs and colors for interior and exterior applications."

Contact them at **Unitex SPG**, Sign Products Division, 3400 E. Randol Mill, Arlington, TX 76011. Tel: 800-835-7446

In the September 1993 Sign Business magazine Morgan Crook has an excellent article on jig and form bending. In case you, too had no idea where to locate **Maronite** (the ideal material to use) he lists **BNZ Materials, Inc.** as the supplier; call 303-978-1199 to find the nearest distributor.

Kent Fiske of Jackson WY writes "If someone hasn't mentioned them, you might like **H&R Co.**, 18 Canal St. Box 122, Bristol PA 19007 – a surplus house for electronics (blowers, switches, solenoids and 'tinker toys')."

From Maureen Havey: "Here are some sources for faders. They're all I know that's out there:

"**Bertonce's** NPS-112 (S) is a scripting transformer, 12V DC, 900 V for $21.96; you can order it with a wall adapter; the NPS-115 (S) is bigger at 3000V and $33.98. I have the smaller model, and it works reasonably well for the price, though it's much better on fading than scripting.

"**Tech 2000** has a Midget Controller to be used in conjunction with its Midget 5000V transformer for $55 and $45 respectively. This set-up is more complicated, as there are six control knobs for adjustment.

"**Neon Dynamics** also has the Flo-Scripter out now: models 3770B, 3775B and 3778B... I haven't ordered any of these recently, so check prices and availability..."

*<Also newly on the market, as seen advertised in the October Signs of the Times, page 140: **Magnatek's** new three-in-one dimmer/flasher/pulser, which unlike any of the above works with regular transformers, up to a total of 960VA. Call them at 708-806-6500 to locate your nearest distributor.>*

Jim Piver, on his new torch setup: "Many neon equipment manufacturers and suppliers offer a pumping and bombarding plant that is completely assembled and ready to operate. None offer the same for glassworking fires, except for the inferior smog pump and vacuum-cleaner-powered units available. Therefore, Mark Cherveny's old equipment article included something very interesting to me, proving, in my opinion, that 'there is nothing new under the sun.' It was regarding the Technical Laboratories glass bending fire. The 1930 ad said, 'It is portable, with adjusting head, permitting convenient manipulation of the glass... It is adaptable to any kind of gas... One of its chief features is that there are no protruding valves or elbows...'

"We have assembled and tested a set of fires with these features, but with a self-contained air supply blower. It will operate on any fuel available, including LP and natural gas.

"The unit operates a Hyde ribbon burner head, crossfires and both splicing and tipping torches. All fires, including the ribbon burner, use venturi mixers. The venturi mixers, in conjunction with the fuel regulator, allow quick, easy, and precise adjustment of the air-fuel ratio and mixture pressure to each fire, with each fire independent of, and unaffected by, the other fires in the system.

"The plant is compact, quiet, self-contained, and inexpensive. The direct-drive regenerative blower has a multi-voltage 50/60 cycle induction motor, which, unlike others on the market, has no commutator or brushes to generate sparks or ozone or wear out. This eliminates the separate blower and related plumbing of both air and gas to each fire.

"Our fires have virtually no set-up time: plug into a standard 120 V outlet, connect to fuel source, switch blower on, turn on gas, light fires, set mix, bend glass. The entire unit, with a 16" Hyde burner, weighs less than fifty pounds, is self-contained and therefore completely portable.

"Because of these and other unique features, a patent was required to market the device. This process is nearly complete, and the device is therefore 'patent pending' so we can demo the fires." Jim can be reached at 26608 188th Ave. SE, Kent WA 98042, Tel: (206) 630-5879.

We were misinformed on the price for a complete swivel kit from **Tordiff Tool Co.** It's $10.50, not $5, but they do work well.

Mark Cherveny of Edmonton: "For permanent marking of glass I recommend **Pilot brand xylene-free gold or silver fine-point paint markers**. You don't need to fire them on (as suggested by Alan Geoffrey, NN#10); they seem to be durable enough when you put them on before bombarding and let them burn on. I prefer the silver, as the Pilot brand gold turns brown when bombarded, but I believe the **Mita** brand keeps its gold color. After about five months of use they seem to be very permanent (it takes a razor blade or sandpaper to remove, which is handy if you have to correct them but doesn't rub off in normal handling) and they don't seem to give you a shock in short lengths. These pens don't seem to have a drying-out problem but they MUST be stored tip-down. These markers can save your sanity on some jobs, for example when you have 60 border tubes that are very similar in length. The installers find large jobs a lot easier to assemble if all the units are numbered in sequence of connecting. Another use for these markers is to mark tubes "special pressure" or a code (i.e., "Dyn" for "Dynamics" pressure) for transformer manufacturer.

"Also I have found **B&D brand insulin syringes** useful for dispensing mercury (the **Monoject** brand won't suck up the mercury). When the mercury is sucked through the small needle, almost all the surface oxides are removed. If the air bubbles in the syringe are expelled it won't oxidize further. There is one precaution, though: toss it out when the plastic has a gray appearance (at least once a year if not more often). It also is a good idea to make a stand for the syringe and put this and mercury stock bottle in a shallow tray to catch any spills. In most parts of Canada you can ask your pharmacist for individual insulin syringes. This is an imperfect substitute for a glass syringe, but most glass syringes I have seen are too large for fine control or don't have a good seal between the plunger and barrel. I have seen some suitable ones in scientific supply catalogs but they are too expensive ($50 and up). Do you know of any glass syringes with rubber- or O-ring-sealed plungers for a reasonable price?" ♦

(Bull, from back cover)

staining for me, and did not affect the ultimate vacuum. Leybold measured our system after a month of doing this and our reading was 10^{-3}. Perhaps Masonlite can explain it better or send the same advice I got from them. What happens in practice is sometimes different from theory. Both sides make sense. Any comments?"

Glenn Karich, Embarrass MN, sent the following queries and comments: "I think it's really important that you publish comments, both positive and negative, on specific products. Manufacturers can clarify their product's apparent shortcomings through rebuttal. *<Thanks for the support; we're trying not to get too timid but still keep our worldly possessions out of litigation danger.>*

"1) When using cold weather blue gas (K4, etc.) which is very rich in neon, can one rely on blue gas chart footages? *<See Sign Business magazine, January 1994, for Morgan Crook's detailed article on gasses.>*

"2) Any comments on Transco's 'revised luminous tube footage chart,' which allows for greater footages? They say 69' is okay for 15mm red and 83' for 15mm blue at 15,000 volts.

"3) Does anyone know what Neon Fluorescent Gold is? It's often referred to on the red side of charts.

"4) I tried 'angel hair manifold filters' from Neon Accessory Co. and found them totally unsatisfactory. They slowed pumping down a lot and made filling a very long and spongy process.

"5) When bombarding I always pre-heat & evacuate moisture, and heat the tubulation to release moisture. Glass seems to contain a lot of moisture from the factory.

"6) I'd be interested in a simple font program with distortion capability that can be run on a simple computer. The programs I've seen offer hundreds of fonts and require lots of power. I think a couple dozen fonts would be fine, and one can always blow up patterns with an opaque projector that are made from a regular printer.

"7) Dr. Argon's double mercury trap for saving time on production runs is really sensible.

"8) I use an old Filter Queen two-speed vacuum cleaner as an air blower. Low speed works best on my system. Used ones are readily available, as are brushes and bearings, and a surge tank and relief valve don't seem to be necessary.

"9) I think a Neon Supply Co-op that could deal directly with manufacturers would be good. After all, we are product manufacturers, and component manufacturers are shipping bulk orders anyway.

"10) I've heard that the International Brotherhood of Electrical Workers considers neon glass benders part of their trade group. Could anyone elaborate on this?

"11) The Minnesota legislature is just now determining laws regarding the disposal of fluorescent tubes." *<See Signs of the Times November 1993 for a detailed look at this.>*

"12) Does mercury contamination in a manifold enter the workspace through the vacuum pump exhaust? My mercury urine test turned out okay." *<You may remember that he needed to collect a gallon for the sample...>*

Terry Collins of Best Neon in Chicago: "You asked about Supra precoated glass in your last issue. I don't know if this is related, but I thought you might like to see it. This is a copy of the label *<"Supro" electrodes from Superior Neon Products Co. in Bronx, NY>* on a box of electrodes I have (15 mil shorties – I still use 'em once in a while). A date was written on the box (6/15/67) which could be either the mfg. or delivery date. They came with some supplies from a bought-out shop this company acquired years ago."

Kirk Tunningle of Big Dog Neon in Waialua HI sent some intriguing ads from October 1949 Signs of the Times: the General Industrial Training Institute in Steubenville OH promised "...you will be taught to do tube bending WITHOUT THE USE OF A BLOW HOSE OR OTHER AMATEURISH GADGETS" (emphasis theirs). "High-paying jobs in the neon sign industry are waiting for men qualified to fill them. Because the usual development of skilled men is slow, the industry has NEVER IN ITS HISTORY produced enough competent mechanics<!> to fill its top-paying positions. Instruction at GITI is designed for the man who is willing to TRAIN for the better jobs in the industry...jobs paying $2 to $3 per hour...jobs that STAND UP in hard times." The school further boasted a perfect placement record and top status in the nation...

Another ad for Haydu Brothers in Plainfield NJ offered a fully-equipped bending table for $262.25 and a pumping and bombarding table for $441.90; the latter including 7.5 KVA bombarder and choke, Cenco pump, glass manifold and even a spark coil!

Great moments in vacuum physics: **Dick Boonstra** sent a lengthy and erudite overview of vacuum science relevant to neon; unfortunately it is both too lengthy and too erudite to reprint in full here (you'd have to crack a college text for Dalton's Law of Partial Pressures and the respective Laws of Avogadro, Boyle and Gay Lussac). However, one historic experiment matched real horsepower with a vacuum to prove the power of nothingness more than three hundred years ago:

"Well known is Otto von Guericke's 1654 experiment with the force of air pressure. It took several days of hard work with watertight rebuilt firemen's pumps to achieve a pressure of 20 Torr in an evacuated ball consisting of two half-spheres. This was placed between two teams of eight horses each, which then set forth to wage a tug of war...

"For the first time, the force of air pressure and/or lack of it was proven... In fact it was a stunt, because fewer horses can do the job much easier. The same experiment with two horses to a team yielded consistent results as well: an enormous big bang each time the sphere pulled apart...

"The experiment took place in Magdenburg, Germany; hence the name Magdenburg half-spheres. These half-spheres, together with von Guericke's (1602-1686) original vacuum pump built from a fireman's pump, still can be seen in the Deutsches Museum in Munich." (Thanks to Roy Dusza for translation.)

Dick has also launched a newsletter for Netherlands neon people called "Ne 10 NEON"...

Orest Tataryn of Toronto promised us more about "my group, Skunkworks - Outlaw Neon," including neon that's "hand-blown & free-formed, pulled off the pipe glass: pumped and installed in the environment and documented around the celebration; suspended from underneath bridges and over rivers; cemetery installations; fire escapes on old buildings; waterfalls; derelict farm equipment; factories; waterfronts, etc. etc. etc." Remember, you heard it here first...

For those of you with the money, time and/or artistic passion, **Washington's Pilchuck Glass School** is offering its usual summer buffet of glass art courses, including "Lyric Possibilities of the Neon Tube," taught by Bill Concannon. For more information, fax 206-621-0713 before May 6.

An update on risque neon artist **Billie Lawless** from the *N.Y. Daily News*, 6/93: "A Cleveland artist charged yesterday that officials at the Manhattan Psychiatric Center suddenly banned him from an outdoor art exhibit after they found out that his sculpture features

(see More bull, page 13)

The envelope please... (a bender's fantasy)

By Audie Foote

I've never been much of a hero-worshiper. Oh sure, as a kid I too daydreamed I was Mickey Mantle making a last inning, game-saving, diving catch to win the World Series, but just last year I outgrew that little phase. Since then I have comfortably come to grips with the fact that I made it to the Big Leagues all right, but in the field of neon, not baseball.

The difference? Well, pull up a chair, Sparky, and Uncle Audie's going to tell you the difference.

I recently heard an interviewer refer to actor Tom Cruise as "brilliantly talented ... a master of his craft ... a genius!" -- as if he was the reincarnation of Mozart, Da Vinci and Albert Einstein all rolled into one highly overrated actor.

Drawing by David Sebesta

Yeah, right, I thought. "But can the chump bend 15mm ruby red glass on a hot day and a deadline? Come here, Tom, master craftsman that you are; you see this strange-looking pattern? Well, here's a Bic lighter, a file and a handful of electrodes. Let's see you bend this! I'll see you in eight hours with your Academy Award and your Excedrin... It's SHOWTIME!"

Is this just a cynical touch of jealousy by a tubebender sitting in his living room with his feet up and his Friday evening beer in his hand and a scowl on his face from making large double-stroke, italicized, serifed letters all day until his back ached and now he's got to watch some quasi-talent millionaire actor get praised as a genius for the relatively simple task of acting like himself on camera?

...Well, yeah, in fact it is a little bitter, but it got me to thinking. Just once I'd like to finish a tough neon job and walk outside to a standing ovation by oh, say, 55,000 ecstatic adoring fans. Just once I'd like a little kid to ask me for my autograph because I was the guy who bent the job that lit up the tallest building in town. And where the heck are all those neon groupies who should be gathered outside my house waiting for me to drive up in my Jaguar pickup truck?

While we're on the subject, how come I'm not in the running for our industry's Most Valuable Something-Or-Other Award? When will I get a glimpse of myself on a highlight film? Why is it that Michael Jackson can win a Grammy for being exceptional in his field and I can't win one in mine? No Pulitzer, no Nobel, no Medal of Honor, no Green Stamps even! What's going on here? And what city will be hosting the next Neon Olympics? Imagine (spotlight and drum roll please)...

"The winner of the gold medal for the 1996 Neon Marathon, from the United States of America -- Audie Foote!" And as the flag-waving crowd goes crazy and the national anthem plays and tears well up I suddenly scream in pain as I realize I just melted a perfectly good piece of glass in the ribbon burner and burned my eyebrows to boot.

Snap out of it, Walter Mitty, it's never going to happen. You see, the folks who make signs and neon for a living aren't real big on tuxedos and limousines. Most are content with having millions of people see their work daily without ever knowing whose masterpiece it is. More people see my neon every day than probably view the works of Van Gogh, but I'll never be on the cover of Time unless I attempt a political assassination (or a large transformer of mine happens to burn down a historic landmark). No, most of us will labor our lives away in ignoble anonymity while the rest of the world gets Emmy Awards and incentive-laden contracts with sneaker endorsements and their own radio shows.

Where's the justice in this? As usual, I have the answer.

Just like Hollywood, we can brainwash and manipulate the world into marveling over our undeniable greatness if we give each other lots of awards in high-profile lavish ceremonies. The winners will appear in People magazine and become instant experts on politics and other fields we know nothing about, and be on Oprah and Geraldo!

All we have to do is meet again in Las Vegas, only this time we call the press. And as each sealed envelope is opened, we all gasp with surprise, and cheer as the winner heads toward the stage as the band plays "Ode to Joy" or "Hail to the Chief" or "Louie Louie" (I haven't worked out all the details yet) and gives an emotional acceptance speech: "I'd like to thank the Neon Academy (sob) and that lovable old drunk who taught me neon so many years ago..." Then, after I snag the "Best Bender" award, others may have a chance at the "Best Neon of the Year" award, or "Best Bender in a Supporting Role" or "Best Installer of the Year." I can imagine endorsing Alpo Dog Food on TV...

This is all within our grasp, folks. All we have to do is agree to attend the First Neon Academy Awards next year in Vegas. I'll work on it in my spare time, but for now I gotta run because the Yankees are on the tube in a few minutes. Ciao! ♦

(More bull, from page 12)

four neon phalluses.

Artist Billie Lawless said he was shocked by the state ban of the work, entitled "Green Lightning," because it already has been displayed without incident<!!> on the streets of Buffalo and Chicago.

He considered the New York show the highlight of his career and had already selected a site putting the sculpture in plain view for patients and visitory to the Manhattan Psychiatric Center hospital on Wards Island.

State officials first denied the entry had been approved for the show, which opened this week. But later, they offered to accept Lawless' work, provided he agreed to show it without electricity at a less conspicuous site on the hospital grounds.

Dr. Michael Ford, director of the center, said prominent display of the sculpture might "provoke the sexual feelings and behavior" of patients. Lawless rejected the compromise, and is expected to appear today in Manhattan Supreme Court, where he has filed a lawsuit asking Justice Ira Gammerman to order the hospital to display his work without restrictions.

The artist was sure "Green Lightning" was what the exhibit's curators had in mind when they sent out a prospectus seeking innovative pieces that "ignored art's familiar conventions."... ♦

EPM, PSDD and other Dutch treats

<Editors' note: Edward has settled into Dutch life better than we ever did, complete with a teaching gig at Delft Technical Institute and work with our old friend Alan Geoffrey, whose Clear Glass Neon is across from a fragrant factory that makes pickled onions in southern Holland. Here's an update from the flat earth:>

By Edward DeZuzio

...The experimentation with post-coated lead glass is proving itself worthy. The piece that we produced at Clear Glass Neon is still bright and stain-free. It amazes me that many people in the trade only believe that it is lead glass once they are told that it was coated via the Philips system. Once the person hears this, the look of curiosity is gone from their face. It's like this: this land is full of neon- and argon-filled tubes which are of consistent color no matter how sharp the bending is. (At CGN the bends are as sharp as 150 degrees!) Yeah, so you can bend glass as sharp as 150 degrees, but will it be pointed, as in having a sharp end, sharp, incisive, very evident?

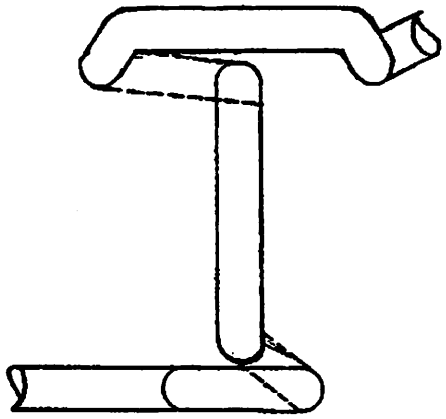
When an experienced glassworker looks at a pre-coated glass sign a bitter, gotta-spit-it-out look covers their face. Their attention is automatically drawn to the bends and the fact that with a lot of the finished work the bends are not the same color as the remainder of the piece. To keep this short I'll keep you informed about any strange happenings with the tubes. For now, I believe they will enjoy a happy stay on the planet.

Sign Europe '93 *<in Dusseldorf, Germany>* was unlike any other trade show I have ever been to. The biggest difference was the fact that I was there to demonstrate techniques along with five other luminous tube glassblowers. It is safe to say that we were blowing people away as well. There were two different techniques of glassblowing among the tradespeople there. Most of the glass was lead glass supplied by Tecnolux. Close your eyes and imagine this: About five hundred kilograms of glass to do with what you wish. Not only 4500 white but all the classic colors as well. Do you see yourself going for the ruby and bromo first? That is exactly what happened. Most of the pre-coated lead glass was pushed to the side. A full three days of bending all the glass you wanted just for the sake of bending. The two techniques at the show consisted of the pointed bending techniques from the Netherlands and the smooth, flowing technique used in America and England. Though a lot of glass was consumed there was still a lot of glass that needed to be loaded on the truck at the end of the show. Maybe we can use it at the next Sign Europe.

One of the more interesting and complex neon objects made for the show was a three-dimensional biplane. Designed and fabricated by Alan Geoffrey, with a wingspan of 48 inches or so, the piece captured the attention of all who walked by. Some of the funky things being made at the show were the responsibility of Matthew Thompson. Natuurlijk! *<That's "naturally" in Dutch.>* Not only could people see the fabrication of letters and signs but also pieces of work with so many bubbles that they would have floated away if it wasn't for the weight of the electrodes! The same pieces being taller than five feet and having twice as much glass were bombed on an Alcatel pump via a very unique metal manifold from De Blaeker *<Dick Boonstra's company>*. Most of the people watching left the booth in awe.

Along with the glass work at the show and the bombing station and all the personalities was a piece of equipment from Tecnolux: a large, self-contained, self-supporting mobile ribbon burner. It has its own source of air with precise controls for a proper working flame. I didn't measure the length of the flame but I think it is at least 24 inches. The unit has foot-pedal ignition, which took some getting used to, but the savings in gas consumption is good compensation. There was another ribbon burner which was used; I think it is manufactured by Ilmenau in Germany. With this burner a length of glass about five feet long could be bent, though this would take a lot of practice time; a two-person team is probably an easier method of working glass over this burner. Spaghetti bending, as lead glass is referred to here, earns the name especially when the piece is in its flexible state over such an enormous length.

One order we worked on recently at Clear Glass Neon called for extremely short serif work, less than one diameter of glass in length.



From my first look at the pattern until the glass was being bent, I couldn't imagine how we would do this. To use the style of bending I am accustomed to would have meant telling the client that the serifs are too short, man; change the layout.

However, CGN is well-known for EPM (exact pattern matching). So, using a standard five-point crossfire, 8/9mm ruby with a heavy soda content (not lead glass), and a soda-glass-bending boss (which is a person and not a piece of equipment), the work was done as ordered.

Alan demonstrated how he would tackle the project on his soda torch. With ease the straight tubes conformed to their new lifestyles. My experience on the same torch also gave the tubes a new lifestyle – but there's enough sand here on the island of Tholen already. I tried the same techniques with the crossfire and this yielded a decent end product. With more and more practice the bends became consistent.

Mind you, neither good nor bad, just consistent. Soda-glass technique is much different and there is still much to get used to. I wussed out and used the crossfires, though I have yet to see anyone else use such a torch for soda work. It's pretty tough to get used to a single-point torch: the glass has to be held differently and moved a lot more.

Both even heating and even wall thickness are essential for working soda. The glass wall is a lot thinner than lead glass. That alone makes control of the glass harder to attain. You can see that for yourself with thin-wall lead glass. This also means that more glass must be gathered to complete a bend.

The strange thing here is that the surface area of glass that was being heated was only one diameter. The amount of glass needed for the bend came from the gathering. For the small work, the glob-o-heated-glass was about one-half of the diameter larger. Because minimal bending marks are used in soda glass, that was the only way to judge the correct amount of glass. Isn't this exciting! (Minimal bending marks are a rule of thumb for the sake of the glass. The glass is practically dripping to the floor and any foreign matter will work its way into the bend; you guessed it... more stress!)

(see Dutch, page 17)

From patriotic pipes to post-coating: A life in neon

<Editors' note: It happens that Neon Lewa, a small family-run business located in the seacoast town of Scheveningen, was both the first and last neon shop we visited in the Netherlands. The Leder family went out of their way to make us feel welcome and to share their technical insights and strategies, which are bracingly different from American neon norms. Ed DeZuzio interviewed Gerard Leder, the firm's patriarch and proprietor, for this story, with translation help from Alan Geoffrey and Gerard's son Eddie. Gerard's photo can be seen in Signs of the Times 4/93, page 137.>

By Edward DeZuzio

Gerard was 16 years young when he introduced himself into the world of neon. He started working with glass in May 1939, yet his experiences with neon didn't commence for another five or six years. As you may recall, 1940 through '45 were the war years. In Holland there was no need nor desire for any sort of nighttime lighting; the blackout was so total that all homes had black curtains. The little sign work Gerard saw was sign installations. In 1940 he was able to quench his desire to work hot glass by producing perfume bottles and patriotically-colored cigarette pipes. With this work experience, he was able to build a firm foundation for teaching himself luminous tube manipulation.

Gerard began his career in the war years, when neon was banned...

Aside from an initial visit to a glass studio in Amsterdam, during the first years of his career he didn't have much contact with other glassblowers. Most of what he learned was learned the hard way, and under one employer. It wasn't for another seven years that contact with more glassblowers became easier to attain. In 1947 a new princess was born, and a giant animated neon stork was assembled as a group project to commemorate the birth. The light of the stork not only lit the streets of Scheveningen but also communication between glass shops. During the same year, the Phillips laboratories sought other high-quality glass shops to produce bent glass for them. The neon market was opening up and drastic changes were coming.

In 1949 dry powders came onto the Dutch market. The colors of clear tubes filled with neon or argon now had other complements to stand with. The use of milk glass was becoming more limited. (For those who have never seen milk glass, the best way to imagine it is by comparing it to today's colored glass but less translucent. I saw a bombarded piece at Neon Lewa and it is hard to believe that any light at all can pass through the glass wall. The pure white, stain-free tube filled with argon and mercury gave off a very quiet blue light. Triplex glass also became a rare element in the production of luminous tubes. Though I haven't seen a piece myself, these tubes were drawn after two or three layers of glass were gathered together, with each layer a different color, for instance blue inside green inside clear. Yet the glass wall was the thickness of a single tube.

New questions and problems arose with the new dry powders, and for some time only one man had the knowledge to properly coat a tube and end up with a superb product. This man not only had the knowledge to coat tubes, but could produce up to a total of four per day! Gerard was not this man, but after trading technical information he became the second who could perform this wonder – for a good old-fashioned binder recipe, Gerard exchanged a schematic of a vacuum pump and instructions for building one. *<Binder is the substance which holds the powder to the tube wall without contaminating the finished tube.>*

After a mere ten years in the business he could build his own vacuum pump, and he was also making transformers and electrodes. The amazing method he used to manufacture the electrodes used a spot welder, although when he asked his boss for such a piece of equipment he received a polite stare. The boss then pointed to the transformer coil winder, and said that it could also be used to make spot welders. The reason for making electrodes was that none were imported from the USA and the only other "imports" came by means of smugglers across the Belgian border.

It was all a labor of love; for 25 guilders a week, Gerard was doing what he wanted to do. In 1952-53, Phillips introduced their wet-solution coating system to the Dutch market. And ever since this time, Gerard and his son and daughter have been producing tubes of superlative quality (one report rated Neon Lewa among the top three in Holland). Using soda glass and the wet-suspension technique, Neon Lewa practices a difficult art.

Another change worth noting is the pricing from the 1950s. Gerard gave me a copy of a 1959 price list. To keep things easy to understand, you must know that one US dollar was worth 3.77 guilders, so a wholesale client could purchase clear bent glass up to 18mm in diameter for $1.05 per foot. Recall from NN#10 that new glass in the New Jersey in 1956 cost only an average of $.57 per foot. That is quite a difference in price, but justifiable by the amount of time and skill needed to manipulate soda glass. Another pricelist from Gerard dated January 1969 shows an increase in price of nearly 60 percent. At this time the minimum charge for glass work was per 100cm. The formula for billing was like this:

Block letters: 4x the height.

Double-stroke block letters: 6x the height.

Script and other letter types were measured with a curvimeter (map wheel).

During the 1960s there was a market for interior tube lighting. At Neon Lewa you can see an example of this type of work. Mounted to the ceiling in the rear of the shop are 32mm mercury pink tubes. They have been burning since 1967 and on the same transformer.

The only time the tubes were not lit was when the electrodes disappeared. When I heard this my mind created a picture of a huge room filled with unmatched pairs of socks, assorted sizes of corks and the electrodes from Gerard's tubes, but this was not what Gerard meant. The electrodes that were used on the tubes had a nickel-plated iron shell, and nickel and mercury do not get along. After some time the shells disappear.

Alan asked Gerard about a pair of green stain-free tubes he has – why the electrodes were still intact as they were fabricated by Phillips in 1967. It seems that those shops which manufacture their own electrodes do so only as they need them, and the Phillips shells were of pure iron.

Gerard didn't have much to say about competition in his younger years, and when Alan asked him about the same subject in today's market he was reluctant to answer. Much of his competition comes from glass shops with very little experience and very little vision for long-term quality. Being a lead glass worker it is somewhat painful to admit that lead glass is also a contributor to the tough competition.

Though Gerard does not work with lead glass, his son Eddie has adapted to today's market demands. Lead glass is available from Neon Lewa if customers request it. Because of import pressure, lead glass is working its way into Dutch glass shops. There are shops that will not consider precoated lead glass as a source of income. It is rumored that lead glass will be banned in the European Community, because of environmental considerations. However, protectionist considerations are evident as well, as officials are under pressure to preserve the Dutch system of luminous tube fabrication... ♦

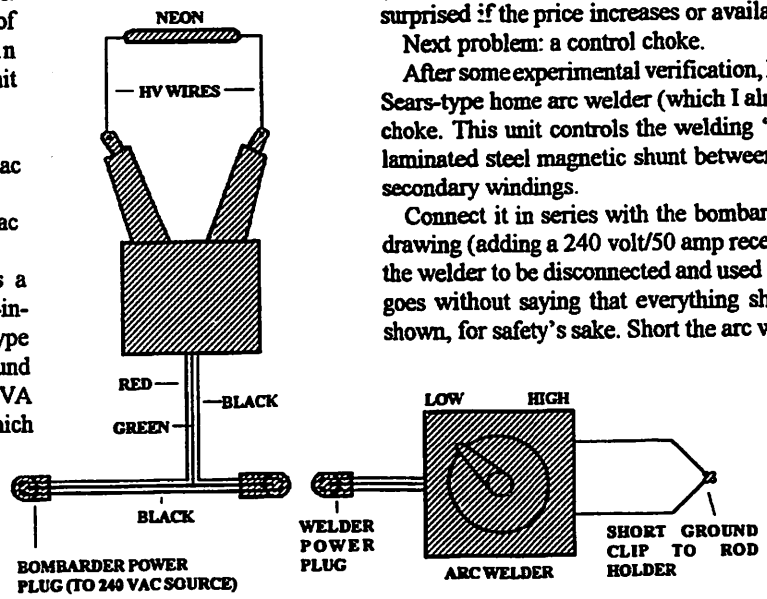
Cheaper yet: Another bombarder and choke combination

ByTelford Dorr

Here's the skinny on bombarders and chokes: I'm using a power company transformer known as a "PT" or potential transformer. I don't know exactly what they use it for – I think it is used as a source of 120 VAC control voltage in switchyards or something. The unit is rated as follows:

– turns ratio: 100 to 1
– "primary" voltage: 12,000 vac (step-down mode)
– "secondary" voltage: 120 vac
– KVA rating: 1.5 KVA

Note that the KVA rating is a continuous duty, 24-hours-a-day-in-Death-Valley-in-the-summer-type rating. For short duty cycles, as found in neon work, I rate it at 6.0 KVA (i.e., 500 ma tube current), which works fine for tubes up to 15mm. I also run it on 240 vac, which also works well.



Here's the kicker: the cost, from SDG&E (San Diego Gas and Electric) is $51.20. No, I'm not kidding; see the attached invoice *<it's true, folks>*. The deal is that SDG&E pulls these units out of service, cleans and fully tests them, and then puts them in storage for future use.

At this point, you can (hopefully) buy them for ten cents on the dollar as scrap (new book price: $512). Heck, even full list ain't bad compared to real bombarder prices, but at fifty bucks, well, I wound up buying two to have a spare. You can't even buy a new 15,000/30 for that!

This deal is probably too good to last. Sooner or later, SDG&E is going to discover it's giving away the store on this one, so don't be surprised if the price increases or availability dries up...

Next problem: a control choke.

After some experimental verification, I determined that a standard Sears-type home arc welder (which I already had) can be used as a choke. This unit controls the welding "heat" output by sliding a laminated steel magnetic shunt between the welder's primary and secondary windings.

Connect it in series with the bombarder transformer, as per the drawing (adding a 240 volt/50 amp receptacle where shown allows the welder to be disconnected and used for its intended purpose). It goes without saying that everything should be well grounded, as shown, for safety's sake. Short the arc welder's ground cable to the electrode holder.

On my unit, setting the welder at the lowest heat allows about 100 mA of tube current. At the highest heat setting, the tube current is about 650 mA. To test this setup, I used an old eight-foot fluorescent tube as a load, in place of where neon would be connected (bombarding current for neon is normal operating current for a fluorescent tube).

I'm not completely sure if the welder appreciates this, but nothing gets overly hot, and there are no bad smells or anything. I've used this setup for over a year with no problems. ♦

(Conductivity, from page 7)

O.D.	I.D.	Conductance
5mm	2.5mm	1
6mm	3.5mm	2.74
8mm	5.5mm	10.65
10mm	7.5mm	27

In other words, increasing your tubulation glass size from 5mm to 6mm could increase the flow rate almost 3 times! Using 8mm to the manifold could increase flow better than ten times! The fly in the ointment here is that the short length of 5mm on the electrode acts as a choke-point. Conductances in series are calculated as follows:

$$C_t = \frac{1}{\frac{1}{C_1} + \ldots + \frac{1}{C_n}}$$

Assume 40mm of 5mm tubulation out of the electrode welded to 200 mm of 8mm diameter glass, going to the manifold:

$$C_{electrode} = \frac{12 \times (2.5)^3}{40} = 4.69$$

$$C_{tubulation} = \frac{12 \times (5.5)^3}{200} = 9.98$$

$$C_{combined} = \frac{1}{\frac{1}{4.69} + \frac{1}{9.98}} = 3.19$$

Notice that the conductance can never exceed the worst part (.e., the electrode), but by using 8mm rather than 5mm to the manifold, the connecting tube has twice the conductance, even at 200 mm long, as the stub out of the electrode. Maybe, for really clean 15mm border tubes, you really want to use non-tubulated electrodes and add old-style tubulation using 6mm glass.

P.S.: I recommend "*Building Scientific Apparatus*" by Moore, Davis, and Coplan (Addison-Wesley 1983) for a detailed practical discussion of vacuum technology and general lab construction. ♦

(Artists' course, from page 1)

have a class that's limited to six, and people can take turns bending. And then they watch the pumping; they don't get to do that themselves.

<So everybody gets a tube at the end of the day?>

You know, the last class I had, I only had three students, so they got to make their own tubes. And they were thrilled with it, because they had welded all these different colors together because I had a lot of leftover colors. But the first class was a little too big, and the students weren't able to make their own stuff. So I felt the smaller class was much better, and I'm going to try to set up the next class so that everybody does get to leave with a tube – and then of course

(see Course, next page)

(Interview, from page 10)

people are really afraid to push it, which I think in a way is good for any neon shop that is doing neon for others. I think that if you're going to push the limits of neon, you really have to have your own shop. Because I think the experimental nature of doing three-dimensional neon... is the most difficult to do for others. What I've found with the 3-D stuff is that the more creative artists ask for that, and usually they're also easier to work with, because they realize that what they're asking for is difficult.

And usually what I require is that they bring the sculpture in and I have it here, so that I can work with the sculpture. It just does not work to make a part to spec and have it fit for 3-D tubes. If it's too big to bring in, then I just wouldn't want to get into it, because how can I make it fit if I don't have it right here where I can heat the tube up again and make it fit?

So I think there's a place where neon benders have to be able to say no if the job doesn't sound right; you can't just let the artist totally tell you how the neon's going to be. The limits have to come from the field; you have to tell them what the limits are.

Because otherwise they come in here with creative ideas for things that really can't be done. Unless you're in your own shop playing around and trying to do it – I think that's the benefit of having a neon shop and being an artist. And I'm not sure that I can charge enough to pass that on to somebody, because to me there's a tremendous amount of creativity that comes into play when you're doing unusual three-dimensional work, and I'm not sure that's something I would do on a custom level. It'd be hard to charge for that.

<Are there any examples you can give of ignorant uses of neon?>

I would say that most ignorant artists tend to use too much neon, that they overpower the viewer – it gives neon the bad reputation of being garish. They also don't play enough with the lighter, softer colors; people tend to want to go with the reds, blue, the simplest colors. And I think a lot of neon shops push that, because then they can just use the clear tubing.

But I charge the same amount for any of the colors (outside of the colored glass; I don't show them the colored glass at all *<laughs>* because it's just too expensive); but all the colors, I feel it weighs out for me. People maybe tend to like the purple more, and that is the most expensive color, but on the whole it's not a huge difference, and I'd rather see it myself; I'd rather see a beautiful color than one that's just too common... ♦

(Course, from previous page)

they have to purchase a transformer...

<So you can keep the cost of the class down a little bit that way.>

It's real cheap for them. They're only paying $35 for the day; it's through the community college. *<She reads the course description:>* "Neon: the basics of light tube production. Neon is a cool, energy-efficient light source with really hot visual impact. Get a first-hand introduction to this eye-catching art form as well as explanation of the skills and equipment required for quality neon tube production and installation. Some hands-on experience is included."

It's still an expensive medium for artists to use. Cheaper than bronze, but more expensive than anything else I can think of.

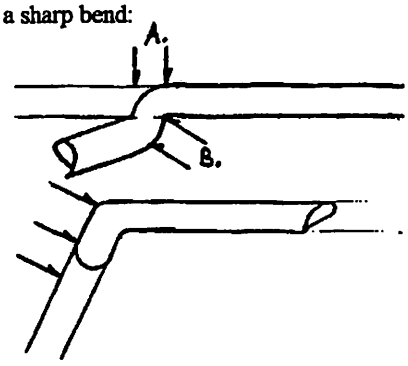
And I did have one woman call me before the last class and say, 'Now, you're going to show us how to set up a neon shop, right?' And I said, well, no, that's not in the course description, maybe you should read it again... It turned out that she was a ceramicist who had to get out of the field because she had carpal tunnel syndrome, and wanted to find a new career.

And I'm not into career planning here; I don't want to show people how to set up and compete with me! Basically I want to get customers – that's what my approach is to this thing...

I think a lot of people have no idea what goes into this, and they think 'Well, maybe I could just set up a shop real quick, and be able to do what she's doing.' And I'm trying to emphasize to people the difficulty of it, and the frustration of it – it's something that, at least for my first year, I had to have a (non-neon) job, until I got this one guy who's been real consistent for me as a customer. But without him, even now I don't think I'd have enough business, just from artists. It's still pretty slim. ♦

(Dutch,from page 14)

If you look at the diagram, this is the general idea for creating a sharp bend:



Be advised: The glass these bends were performed with was uncoated. Using these instructions for coated glass may yield PSDD (permanent stress and discoloration disorder). The minuscule, almost nonexistent marks are placed at point A and the glass is heated.

Upon the completion of gathering the first bend is done. It is part 90° and part drop-rise. There is absolutely no pulling of the glass: that will come later. If other distortion of the glass is necessary it should be that of pushing.

The second heat is applied to point B. If the glass wall is too thin, or is that of a tube which is not yet bent, then increasing the wall thickness should be done now. The excess glass, in wall thickness, is used for completing the tube's tubular shape.

When the glass is hot enough, really hot enough, it can be put into shape. Not only must the glass be brought to a straight run again but the wall must remain thicker. Once the glass is somewhat to the designer's liking (refer to EPM) it is blown out, but more than to just keep the glass tubular. It is overblown and brought back to diameter by slight repeated pulls. The slight pulling is done while the glass still glows red.

For the double-back, heat can be applied at the marks shown. Careful consideration must be given to wall thickness but I experienced less trouble reheating the glass. (Less trouble than with reheating lead glass, that is).

With some practice sessions I have made the same bends with uncoated clear and gold glass. I still have to work on the EPM... ♦

BULLETIN BOARD

Noland Carter, W. Hollywood CA, writes: "Where would I find a supply of Geissler tubes? I've even read in a book (*The Boy Electrician*) that some of these tubes were water-jacketed. I'd be grateful if you'd help me out on this..."

Ted has this query: Who makes safety devices for standard (non-solid-state) transformers which disconnect the primary power if a problem occurs?

Neon enthusiast and radio engineer **Jeremy Storm** offered this tip: If you have a small solid-state transformer (in my case, a Tech 2000 3,500-volt AC model) and a tube that won't quite light unless you touch it (which, according to **Tom Skarvada**, means that you're just past the limit of what it'll run) you can run a grounded wire to the middle of the tube and have it physically touch it – in my case it formed one of the hold-down ties, and was therefore quite inconspicous. This way the tube lights up every time by itself with no problem.

Seen, held, but still not quite believed: A 42-lb. two-in-one 15,000/30 transformer (or is that 15,000/15,000/30?), made by **National Transformer Corp.** in Paterson NJ sometime, I'd guess, in the thirties or forties. This sucker is 4.5" wide, 10" long and 8.5" tall, and has one pair of small lugs for the primary input and then two separate pairs of large lugs for two independent 15,000-volt outputs. I dragged it out of the Palace Theatre marquee (Hilo), in the course of general overhaul, along with 12 beautiful, aerodynamically correct General Electric transformers from the '30s which, like the Thordarson models, have screw-on ceramic end-caps to cover the high-tension connection.

Telford Dorr sent "a computer disk from the Motorola people, which is useful for finding specs on all the electronic parts in your junk box. Copies are free: call (800) 441-2447."

Candice King sent another perspective on mercury management: "In Dick Boonstra's article he says never to flame a mercury trap. But if you do so very lightly, it releases the water vapor attached to the mercury, and these molecules are very light and pump away quickly. The mercury re-condenses on the tubulation before it reaches the pump or manifold. This has reduced snaking and

(see Bull, page 12)

Get on the grapevine: Directory planned

In the spirit of "dyslexics untie!" (graffiti seen years ago in Minneapolis) we're putting together a "tubehead" directory. This way you don't have to bug us just to get someone else's number.

What we'll do is type up a master list, photocopy it and mail it to everyone on the list. To cover our expenses we'll add up the total and divide it by the number of recipients (probably a few bucks). We'll update the list in six months; meanwhile if someone wants a copy, they pay us the money and submit their name for the next issue. Sound good? Bad? We're winging it here...

What we don't want, of course, is selling, nor taking up valuable business-day minutes with long-windedness. So please respect others' time.

Send to *Neon News*: Your name, city, company (if it matters), best number to call (if calling is okay), best time to call, address, $2, and a fax number if you have one.

Also note what your neon-related interests/habits/vocations are. For example: neon tubebender; neon installer; neon artist; neon putz-a-rounder; neon junkie; neon techno-nerd; neon employee or employer or self-employer...

ADS

Neon patterns – drawn by a glassblower for glassblowers. Already marked and reversed! Over 100 patterns: art deco, window signs, alphabets (including E-Z and fancy script), border designs and scrolls. This book will make you money! To order send $25 to Spectrum Neon, 18374 Locust, Lansing IL 60438.

Neon News T-shirts: Many colors available; white ones have hand-colored letters for a real neon look. $10 each in large, extra-large and kid sizes. (For an additional $3 we'll enclose a sample issue so your friends will know what they're wearing.)

Colorful neon postcards: Pontiac Indian, Hojo's lamplighter, Buster Brown, etc. 15 assorted, $8.50; 50 cards, $13.50. Davidson, 860 N. 26th St., Philadelphia PA 19130; (215) 232-0478.

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